(12) UK Patent Application (19) GB (11) 2 272 707 (13) A

(43) Date of A Publication 25.05.1994

(21) Application No 9308604.9

(22) Date of Filing 26.04.1993

(30) Priority Data
(31) 9224429 (32) 21.11.1992 (33) GB

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(51) INT CL[5]
F16C 33/20

(52) UK CL (Edition M)
D1R RGZ R162 R309 R503 R527 R543 R551 R562 R612 R623
F2A AD44 A101 A129 A171 A180
U1S S1832 S2031

(56) Documents Cited
GB 2065043 A GB 2021702 A US 4908176 A

(58) Field of Search
UK CL (Edition L) D1R RFA RFZ RGA RGZ, F2A AD44
INT CL[5] B29C, D04H, F16C
Online databases:WPI

(54) Improved composite bearing materials

(57) Polyester fibre felt is used as a reinforcement for cured organic resin composites for use as bearing materials, e.g. for shafts in marine applications. The felt may be needled or stitch bonded. A phenolic or polyester resin may be used.

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Improved composite bearing materials

This invention relates to fibre reinforced composites of the kind wherein textile fibres are employed as reinforcement in a polymeric matrix material. In particular the invention is concerned with non-asbestos composite bearings based on a thermoset resin matrix and including an organic fibre reinforcement.

Fibre reinforced composite bearings of the above kind are well-known. They find utility in such applications as marine propeller shaft bearings. For this latter application whether lubricated by oil or water, it is usual to produce the composite article from cloth impregnated with a curable resin, typically a phenolic resin. This is then converted to a composite material by one of two routes. Firstly, it may be rolled around a mandrel to form a thick walled tube. Secondly, several layers may be superposed, to make a flat or curved sheet. In both cases, the resin impregnant is thereafter cured under heat and pressure to yield an essentially rigid product which may thereafter be sawn, or machined into bearing components.

Asbestos cloth was traditionally employed as reinforcement for composites intended for marine bearing applications where water is the primary lubricant. However, attempts to replace asbestos by, for example, woven polyester fabrics, have not been entirely successful, primarily for cost reasons. Polyester fibres are vulnerable to chemical attack by adventitious material in the resin system, such as free phenol, in the case of phenolic resins. Also, polyester fabric is relatively expensive and lacks the resin absorbing high surface area and structural mass of asbestos cloth.

It is an object of the present invention to provide an improved non-asbestos composite bearing.

According to this invention, a non-asbestos fibre-reinforced composite bearing comprises a cured organic resin binder including a felt of polyester fibres as reinforcement.

The felt may be a needled or a stitch bonded felt, the latter being preferred. Surprisingly, it has been found that such a felt can replace an expensive conventional woven polyester fabric with no significant deterioration in properties.

Particularly preferred resins include polyester resins and phenolic resins containing less than about 2% by weight of free phenol.

Examples

In order that the invention be better understood, four preferred embodiments of it will now be described with reference to the following Examples. The first two Examples utilised a thermally bonded polyester fibre felt having a density of 150g/m².

In Example 1, the felt was impregnated with a phenolic resin containing less than 2% of free phenol and press cured into a laminate slab containing 21 layers of felt.

Example 2 was made in exactly the same way, but used an unsaturated polyester resin instead of the phenolic resin.

In both cases, laboratory equipment was used to make the laminates.

The products were tested by conventional means, with the following results.

	EXAMPLE 1	EXAMPLE 2
Resin content approx %	56	50
Tensile Strength MPa	59	64
Compressive Strength MPa	306	263
Impact Strength kJ/m²	52	40
Bond Strength kN	2.55 (4.92mm)	2.4 (5.31mm)
Water Absorption % Wt	1.75	1.13
Swell 20°C % thickness	0.46	0.38
Swell 80°C % thickness	1.54	1.42
Density g/cm³	1.33	1.26

Note that bond strength was measured on the sample thickness in parenthesis, by pressing a steel ball into the sample until failure occurred.

The above test results were fully commensurate with those obtained using much more expensive polyester fabrics. The tensile strength was slightly lower, although for bearing applications, this is not critical, because behaviour in compression is more important.

The products were readily sawn/machined into bearing components. The performance of the latter, particularly in water-lubricated marine applications was very acceptable.

Examples 3 and 4 both used a stitch bonded polyester felt, the bonding being carried out with a polyester thread at a stitch density of about 2.5 per inch. This was processed on production equipment as follows.

EXAMPLE 3

A cured laminate sheet was made from a stitch bonded polyester felt of density 350g/m² and a phenolic resin content of 60%, by weight. On testing it exhibited the following properties.

Tensile strength	40 MPa
Compressive strength	250 MPa
Impact strength	25 kJ/m²
Bond strength	3.5 kN (on a sample thickness of 6.35mm)
Water absorption	2%
Swell at 20°C as % of thickness	0.5
Swell at 89°C as % of thickness	1.0
Density	1.31 g/cc

The finished sheet was cut into generally trapezoidal section staves which were assembled side by side in a supporting cage to form a tubular bearing, the performance of which in a water-lubricated marine shaft bearing application was very satisfactory.

EXAMPLE 4

A tube was made from a stitch bonded polyester felt of density 200g/m² and a phenolic resin content of 70% by weight, the method employed being to wrap the felt under tension onto a mandrel. The wrapped felt was baked in an oven at 135°C. The cured tube produced by removing the mandrel had the following properties.

Compressive strength	180 MPa
Bond strength	4.5 kN (on a sample thickness of 6.35mm)
Density	1.31 g/cc

Its other properties were generally commensurate with those listed in relation to Example 3. The performance of a water-lubricated bearing made from the tube by cutting/machining was also good.

CLAIMS

1. A non-asbestos fibre reinforced composite bearing comprising a cured organic resin binder including a felt of polyester fibres as reinforcement.

2. A non-asbestos composite according to claim 1 wherein the felt is a needled felt or a stitch-bonded felt.

3. A non-asbestos composite according to claim 1 or claim 2 wherein the resin is a phenolic resin.

4. A non-asbestos composite according to claim 3 wherein the phenolic resin contains less than 2% by weight of free phenol.

5. A non-asbestos composite according to claim 1 or claim 2 wherein the resin is an unsaturated polyester resin.

6. A non-asbestos composite bearing substantially as described with reference to the Examples.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9308604.9

Relevant Technical fields

(i) UK Cl (Edition L) D1R (RFA, FRZ, RGA, RGZ); F2A (AD44)

(ii) Int Cl (Edition 5) B29C; D04H; F16C

Search Examiner
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Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search
3 JUNE 1993

Documents considered relevant following a search in respect of claims 1-6

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2085043 A (NORWOOD) - see example page 2 lines 94-104 and page 3 line 27	1,2
X	GB 2021702 A (INCOM) - see whole document, especially page 2 lines 126-129	1,2,3
X	US 4908176 (KATO) - see example column 3 lines 3-31	1,2

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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P: Document published on or after the declared priority date but before the filing date of the present application.

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&: Member of the same patent family, corresponding document.

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